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13. ABSTRACT (Maximum 200 words)

One PhD student graduated during the course of the AASERT award. He undertook a one year post doctoral position at Sandia Laboratory in Livermore and is now an Assistant Professor at Florida State University. Another MS student graduated and found a position in manufacturing industry. One continuing PhD candidate graduate student was supported by the AASERT award. The student completed his course work and began full time research in the summer of 1996. A major part of the research effort during the period of the AASERT award was the re-design of a system to produce a spray of liquid in a well defined simple geometry. Loadings of about 50% were obtained with the new system. Measurements of the dispersion of tagged fluorescent particles were obtained by filtering the intense Mie scattering with a combination of colored glass and holographic filters. The measurements showed that the presence of the dispersed phase had a strong impact on the particle dispersion. The graduate students who were assigned to this project gained valuable experience in turbulent two phase fluid mechanics, optics and laser diagnostics as they were involved in assembling the droplet measurement system.

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FINAL REPORT

AASERT AWARD F49620-92-J-0364

15 JUNE 1992 - 14 JUNE 1996

Summary:
One PhD student graduated during the course of the AASERT award. He undertook a one year post doctoral position at Sandia Laboratory in Livermore and is now an Assistant Professor at Florida State University. Another MS student graduated and found a position in manufacturing industry. One continuing PhD candidate graduate student was supported by the AASERT award. The student completed his course work and began full time research in the summer of 1996. A major part of the research effort during the period of the AASERT award was the re-design of a system to produce a spray of liquid in a well defined simple geometry. Loadings of about 50% were obtained with the new system. Measurements of the dispersion of tagged fluorescent particles were obtained by filtering the intense Mie scattering with a combination of colored glass and holographic filters. The measurements showed that the presence of the dispersed phase had a strong impact on the particle dispersion. The graduate students who were assigned to this project gained valuable experience in turbulent two phase fluid mechanics, optics and laser diagnostics as they were involved in assembling the droplet measurement system.

Final Report:
Research continued on the measurements of dispersion of droplets in a turbulent round jet. A MS thesis was written concerning the effect of variations in droplet response times and jet time scales by changing droplet diameters and jet Reynolds numbers. Valuable data for modelers was produced by the MS student. A simple scheme for reducing the cost of calculations in self preserving turbulent flows was formulated in light of the results in the thesis.

Extending the experiment to a spray with a significant mass loading of liquid proved to be a major impediment to progress during the period of the AASERT award. The original design of the experimental rig used two ultrasonic atomizers to produce a fine spray. The spray was directed through a duct and eventually out a nozzle along with the flow of air. The design attempted to prevent the impact of spray droplets on the wall by using porous walls through which air was bled. This method was able to yield a spray mass loading of only around 7% maximum. Dripping off walls became severe beyond this mass loading. Therefore, an entirely new approach has been adopted to produce the spray.

A series of miniature air blast atomizers have been installed within the nozzle in a straight section near the exit. Some uniformity of the exit flow of the spray has been sacrificed but we are now able to reach much higher mass loadings of liquid in the spray, around 50%. This loading is achieved without dripping from the nozzle. As before, the fluorescent particle is formed by the piezo drop generator and introduced into the spray.

Because of the much higher spray mass loading that it is now possible to achieve, the photomultiplier tube that was used for position detection has been moved off axis to

the side of the jet. It was subject to excessive wetting when it remained in its axial viewing location. The laser sheet no longer spans the entire jet. In order to cut down on the amount of Mie scattering from the denser spray, the laser sheet has been confined to a narrower strip. Consequently, measurements of the particle dispersion are now performed in a piece wise manner across the jet. This is more time consuming but does not sacrifice accuracy.

The AASERT award has supported two graduate students and has been of assistance in the summer research of an undergraduate student. The first student has graduated and is now in a faculty position at Florida State University. The second PhD candidate has completed his course work and is engaged in full time research.

Personnel:

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